

Claims

- 1 1. A method of determining a clock gating function for each of a set of clocked state-
2 holding elements, wherein the elements have at least one common input and the
3 method comprises the steps of:
 - 4 a. determining, for each element, the conditions under which the element will
5 hold its current value based only on the common inputs ; and
 - 6 b. combining, for each element, the determined conditions to form the clock
7 gating function for that element.
- 1 2. The method according to claim 1, further comprising the step of, for each element,
2 defining a Boolean function comprising variables forming the input to each element.
- 1 3. The method according to claim 2 wherein the step of determining the conditions
2 under which the element will hold its current value is based on said Boolean
3 functions.
- 1 4. The method according to claim 2 wherein the Boolean function is limited to the
2 variables being common to the inputs of all elements.
- 1 5. The method according to any one of claim 2, further comprising the steps of:
2 determining a first set of variables that are common to logic functions forming the
3 input to all elements; and determining a second set of variables that are not common
4 to logic functions forming the input to all elements, such that, in tracing back an
5 input of any element, a variable of each set is always found.
- 1 6. The method according to claim 5 wherein the step of defining the Boolean function
2 for each element is dependent upon those variables in the first and second sets.
- 1 7. The method according to claim 5 wherein the step of defining the Boolean function
2 for each element is dependent only upon those variables in the first set.

1 8. A method according to claim 7, wherein the step of defining the Boolean function for
2 each element further comprises the steps of defining a Boolean function in
3 dependence on those variables in the first sets, and subsequently eliminating those
4 variables in the second set.

1 9. The method according to any one of claim 5 wherein the step of determining the first
2 and second sets of inputs comprises the steps of:

3 a. defining an input cone for each element, each input cone being determined by
4 tracing back from the input of its respective element through a predetermined
5 number of gates, and entering all variables located in that input cone;

6 b. determining variables in the input cones that are common to all input cones;

7 c. tracing back from each element until any common variable is found, wherein
8 all common variables found define a first set of variables;

9 d. tracing back from each element until a variable in the first set is found,
10 wherein all such traced back variables define a set L;

11 e. defining a set M which comprises all variables in the input cones that are not
12 included in set L; and

13 f. tracing back from each element until a variable in the set M is found, wherein
14 all variables that can be so traced back define a second set of variables.

1 10. The method according to claim 9 wherein a maximum size is allocated to the first set,
2 further comprising the step of terminating the step c) if said maximum size is
3 reached.

1 11. The method according to claim 9 wherein the tracing of an input path is terminated
2 in step c) if a common variable is identified.

1 12. The method according to claim 9 wherein the tracing of an input path is terminated
2 in step c) if a variable not in an input cone is identified.

- 1 13. The method according to claim 2 wherein the method is enabled responsive to the
2 Boolean function for each element being dependent upon the output of that element.
- 1 14. The method according to claim 1 wherein the conditions are combined in an AND
2 function.
- 1 15. The method according to claim 1 further comprising the step of creating a gate
2 structure corresponding to the combined conditions.
- 1 16. The method according to claim 2 further comprising the step of, for each element,
2 determining a revised Boolean function which provides the same result as the
3 defined Boolean function when the gating function has a logical value of 1.
- 1 17. The method according to claim 16 further comprising the step of selectively replacing
2 a defined Boolean function with a revised Boolean function in dependence upon a
3 comparison of each defined and revised Boolean function to determine the most
4 efficient function.
- 1 18. The method according to claim 17 wherein the most efficient function is the one that
2 can be implemented with a smaller number of implementations in terms of logical
3 gates.
- 1 19. A computer program product comprising a computer program code for determining
2 a clock gating function for each of a set of clocked state-holding elements, wherein
3 the elements have at least one common input and the method comprises the steps of:
- 4 a. determining, for each element, the conditions under which the element will
5 hold its current value based only on the common inputs; and
- 6 b. combining, for each element, the determined conditions to form the clock
7 gating function for that element.

1 20. An apparatus for determining a clock gating function for each of a set of clocked
2 holding state elements, wherein the elements have at least one common input and
3 the apparatus comprises:

4 a. means for determining, for each element, the conditions under which that
5 element will hold its current value based only on the common inputs ; and

6 b. means for combining, for each element, the determined conditions to form
7 the gating function for that element.

1 21. The apparatus according to claim 20, further comprising means for defining, for
2 each element, a Boolean function comprising the variables forming the input to each
3 element.

1 22. The apparatus according to claim 20 further comprising: means for determining a
2 first set of variables that are common to logic functions forming the input to all
3 elements; and means for determining a second set of variables that are not common
4 to logic functions forming the input to all elements, such that in tracing back an
5 input of any element, a variable of each set is always found.

1 23. The apparatus according to claim 22 comprising:

2 a. means for defining an input cone for each element, each input cone being
3 determined by tracing back from the input of its respective element through a
4 predetermined number of gates, and entering all variables located in that
5 input cone;

6 b. means for determining variables in the input cones that are common to all
7 input cones;

8 c. means for tracing back from each element until any common variable is
9 found, wherein all common variables found define a first set of variables;

10 d. means for tracing back from each element until a variable in the first set is
11 found, wherein all such traced back variables define a set L;

- 12 e. means for defining a set M which comprises all variables in the input cones
- 13 which are not included in set L; and
- 14 f. means for tracing back from each element until a variable in the set M is
- 15 found, wherein all variable that can be so traced back define a second set of
- 16 variables.

1 24. A computer system comprising the apparatus for determining a clock gating function
2 for each of a set of clocked holding state elements, wherein the elements have at least
3 one common input and the apparatus comprises:

- 4 a. means for determining, for each element, the conditions under which that
- 5 element will hold its current value based only on the common inputs ; and
- 6 b. means for combining, for each element, the determined conditions to form
- 7 the gating function for that element.